Spontaneous Speech Measures and Tense Marking in Spanish SLI

A Senior Honors Thesis

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by

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Abstract

Language development is measured in various ways. Research into specific language impairment (SLI) has shown that English-speaking children have severe difficulties producing and judging the grammaticality of tense-related morphology. This has been less clear for child Spanish. Another line of research into SLI in child Spanish has shown that various measures of spontaneous language can be useful in identifying children with SLI. A classical measure, mean length of utterance (MLU), was developed in English. In spite of MLU's utility for understanding the development of the English language in children, inconsistencies still exist in other languages. In this project, we test both the tense-marking abilities and a range of spontaneous language measures of a sample of Spanish-speaking children in Mexico City (n=55), 26 of whom are identified with SLI. The aim of this study is to determine the adaptability of MLU in order to predict morphosyntactic development in Spanish. Furthermore, the study determined that MLU can distinguish typically-developing (TD) monolingual Spanish-speaking children, from children with specific language impairment (SLI). In this study, eight different measures of language development were examined: MLU word, MLU morpheme, MLU verb phrase, number of different words (NDW), subordination index, mean length of terminable units (MLTU), grammatical errors per t-unit, and type/token ratio (TTR). All measures are statistically significant in distinguishing between TD and SLI children except for grammatical errors per t-unit, which was expected. If children with SLI can be diagnosed earlier with the help of these measures, they may benefit from early intervention and may be less likely to develop dyslexia or more severe reading difficulties.

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Chapter 1: Introduction and Literature Review

Section 1.0: Introduction

Specific language impairment (SLI) is a developmental language disorder that only affects language. Unlike other impairments or syndromes, children with SLI have typical nonverbal IQ scores, do not have neurological damage or hearing impairments, and do not have abnormalities in physical or social interactions. My thesis looks at typically developing children and children with SLI from Mexico City. In English, mean length of utterance (MLU) is the standard measure of language development. In Spanish however, there are a variety of measures of spontaneous language that may be useful in identifying children with SLI. I look at two tests (one expressive and one receptive) and 8 measures of spontaneous language to see which one (or which combination of measures) is best at distinguishing between neurotypical children and children with SLI. Due to SLI's many exclusionary principles, if there is a measure/combination of measures that can accurately distinguish the two populations, there will be another inclusionary principle to help diagnose children with SLI. If children with SLI develop without therapy, they are very likely to acquire reading disorders when they begin school, including dyslexia. Therefore it is important to be able to diagnose children at an earlier age so that early intervention can begin.

Section 1.1: Indices of Grammatical Development (IGD)

Over the years, various measures have been created in order to analyze linguistic productivity in children. 'Indices of grammatical development' (IGD) is a general term that will be used in this thesis to refer to different ways of measuring of grammatical development. The eight that are used in this study include: mean length of utterance in

morphemes (MLUm), mean length of utterance in words (MLUw), mean length of utterance in words in the verb phrase (MLUvp), number of difference words (NDW), the type-token ratio (TTR), mean length of terminable unit (MLTU), errors per terminable unit (Errors/TU), and the Subordination Index (SUB-I).

Roger Brown was the first to look at language development in terms of mean length of utterance in morphemes (MLUm). Brown wrote the book, A First Language, and he is considered one of the founders of the modern study of language development. He proposed five stages of development and the stages provide a framework within which to understand and predict the path that normal expressive language development usually takes, in terms of morphology and syntax. Brown and his colleagues conducted a longitudinal study of the development of English as a first language in the preschool years of three children: Adam (2;3), Eve (1;6), and Sarah (2;3), with ages from when the study began. These three children were chosen because they were just "beginning to speak multi-word utterances, had highly intelligible speech, and were highly voluble," which meant that he could get useful transcriptions within a reasonable amount of time. The main data for the study came from transcriptions of spontaneous speech of mother/father and child in conversations in their homes.

Since the children were not the same age at the beginning of the study, Brown "equated them from the length of their utterances, both the mean length (MLU) and the upper bound or longest utterance" (53). Brown argued that MLU was a valuable means of measuring language development in child English because "…almost every new kind of knowledge increases length: the number of semantic roles expressed in a sentence, the addition of obligatory morphemes, coding modulations of meaning, the addition of

negative forms and auxiliaries used in interrogative and negative modalities, and, of course, embedding and coordinating" (53). These are the rules that Brown used for calculating mean length of utterance and upper bound:

1. Start with the second page of the transcription unless that page involves a recitation of some kind. In this latter case start with the first recitation-free stretch. Count the first 100 utterances satisfying the following rules.
2. Only fully transcribed utterances are used; none with blanks. Portions of utterances, entered in parentheses to indicate doubtful transcription, are used.
3. Include all exact utterance repetitions. Stuttering is marked as repeated efforts at a single word; count the word once in the most complete form produced. In the few cases where a word is produced for emphasis or the like count each occurrence.
4. Do not count such fillers as mm or oh, but do count no, yeah, and hi.
5. All compound words (2 or more morphemes), proper names, and ritualized reduplications count as single words.
6. Count as one morpheme all irregulars of pasts of the verb.
7. Count as one morpheme all diminutives because these children at least do not seem to use the suffix productively. Diminutives are the standard forms used by the child.
8. Count as separate morphemes all auxiliaries. Also all catenatives: gonna, wanna, hafta. These latter counted as single morphemes rather than as going to or want to because evidence is that they function so for the children. Count as separate morphemes all inflections, for example, possessive, plural, third person singular, regular past, progressive.
9. The range count follows the above rules but is always calculated for the total transcription rather than for 100 utterances.

Brown divided the children's language development into the following five stages, which can be indexed by MLU.

Stage of Finiteness Development	Mean Length of Utterance (MLU)
I	1.75
II	2.25
III	2.75
IV	3.50
V	4.00

Table 1.1 - Expected MLU for each stage of finiteness development

As a child reaches Stage V, the index loses its value as an indicator of grammatical knowledge. Brown also realized that linguists were going to run into some serious inconsistencies and uncertainties with languages other than English when calculating MLU. Following Brown's work, other researchers have demonstrated that MLU is also implicated in children with language disorders as an index of language delay.

MLU is a measure of morphosyntax in child language development and as such, it is important to note how and when children develop their morphemes. According to Brown, there are 14 morphemes that are acquired in the following particular order by the 3 English-speaking children he studied. They are:

1. Present Progressive
2. Preposition in
3. Preposition on
4. Plural
5. Past irregular verbs
6. Possessive
7. Uncontractible copula
8. Article use
9. Past regular verbs
10. Third person regular
11. Third person irregular
12. Uncontractible Auxiliary
13. Contractible Copula

14. Contractible Auxiliary

Since the morphemes are acquired in a certain order, they correlate with the stages (I-V) stated above. In Stage I, negatives are usually created by tacking on a negative marker (*no wipe finger*). In Stage II a child begins to use his/her first lexical verbs (*eat, put, make*), transitive verbs, present progressive and auxiliaries (*hafta*, *gonna*, *wanna*). Also, first negatives (*can't, don't*) begin to appear in his/her speech. Negative markers appear inside the sentence, but there are no auxiliaries yet (*I no want that*). During Stage III children use modals and auxiliaries (*can*, *will*) and use irregular verbs correctly. Yes/No questions and Wh-questions begin to appear. At first, subject and verb may not always agree, but by Stage IV, they are almost always in agreement. Wh-questions are usually formed without an auxiliary (*Where me sleep?*) and later within this stage, auxiliaries are included but often times in the wrong place (*Where I do sleep?*). In Stages III and IV, *not* replaces *no* in the middle of an utterance. Auxiliaries and copulas are used inconsistently (*I not crying*). Also, children add *isn't* and *aren't* in these stages of grammatical development. Sometimes children use double tense marking (*I didn't caught it*) and sometimes use double negatives (*No one didn't come in*). In Stage IV, more modals and auxiliaries are added (*may*, *might*, *must*) and irregular verbs become overregularized (*sitted*, *eated*, *runned*). Articles 'a' and 'the,' have not been established as having separate acquisition points, but only one for the two combined. When a child needs to decide between 'a' or 'the,' they usually supply the correct form. This means that children acquire the knowledge of definite versus indefinite, according to Brown, who also suggests that the forms of negation are acquired depending on ambient language and therefore semantics, syntactic complexity, and input affect acquisition.

Following Brown (1973), De Villiers & De Villiers (1973) carry out a cross-sectional study involving 21 children ranging in age from 1;4 to 3;4. The study, done with two different methods, was designed to confirm and follow up on the results of Brown (1973). Both studies involved the analysis of spontaneous speech samples in order to confirm the presence or absence of each of the fourteen morphemes in obligatory contexts.

The results obtained from the De Villiers & De Villiers study reflected the same relative order of acquisition of morphemes found among the three children in Brown's study. The order in which the children began to consistently use each morpheme showed a remarkable degree of consistency between the two studies. Due to the high correlation between the two procedures of morpheme ordering, suggests that "at any given MLU the morphemes show a fairly similar ordering, as would be expected if the acquisition curves for the morphemes are similar not just for a single child, but for all the children taken together" (p. 271). It is also apparent in this study that "MLU is a far better predictor of the acquisition of the 14 morphemes in the early stages of language development than is chronological age.

Morphemes	Brown average ranking order	De Villiers and De Villiers Method I	De Villiers and De Villiers Method II
Present progressive	1	2	4
On	2.5	2	2
In	2.5	4	1
Plural	4	2	3
Past irregular	5	5	5
Possessive	6	7	11
Uncontractible copula	7	12	10
Articles	8	6	8
Past regular	9	10.5	7
3rd Person regular	10	10.5	12
3rd Person irregular	11	8.5	6
Uncontractible auxiliary	12	14	14
Contractible copula	13	8.5	9
Contractible auxiliary	14	13	13

Table 1.2 – Order of Acquisition of the 14 Morphemes from Brown's Longitudinal Study and in Terms of the Two Ordering Procedures Used in De Villiers and De Villiers Cross-Sectional Study

Turning from morpheme acquisition orders to IGDs, I briefly review the measures that will be used with our Spanish child language sample. The methodology used in English language studies was an analysis of spontaneous spoken speech, which can be problematic in null-subject languages such as Spanish. Results from Bel (2003) suggest that in adult Spanish, overt subjects are only produced with 20-30% of verbs. Without an overt subject, it is difficult to analyze spontaneous speech for subject-verb agreement. Furthermore, adult speakers may perceive a bare stem form as being finite because of their adult interpretation of the context, when the verb is actually intended to be nonfinite. Nonfinite forms include infinitives while finite forms must mark for tense, aspect, case, or agreement. Most importantly, subjects, which are normally included in an MLU calculation, are used largely as a function of discourse pragmatics in Spanish. Since

verbs are already marked for person, subjects are not always a necessity. As a consequence, including them in an MLU calculation may not measure strictly morphosyntactic development in the same way that it does in English. Therefore, we added a measure called mean length of utterance in verb phrase (MLUvp) which is similar to MLUw, while omitting the subject since many times it is not overtly stated.

The Type-Token Ration (TTR; Templin 1957) is traditionally used to measure lexical diversity. The total number of words or tokens need to be counted and then divided into the number of different words or types in the sample. Watkins, Kelly, Harbers, & Hollis (1995), compared TTR with Number of Different Words (NDW) in a speech sample to distinguish children with typically developing and impaired language development and found that NDW was more sensitive to children's lexical diversity than TTR, which did not distinguish typically-developing from language-impaired children. Similarly, children with SLI did not generally differ from same-age peers on this measure as shown by Owen and Leonard (2002).

Another measure we look at is mean length of utterance per T-unit (MLTU; Hunt 1965), which was originally developed for analyzing written language, but is nonetheless often used to analyze spontaneous oral speech. A T-unit is one main clause with all the subordinate clauses and nonclausal phrases attached to or embedded in it. Loban (1976) showed that there is a steady increase in T-unit length in words during teenage years, but with bigger changes in their writing rather than speech. Scott and Windsor (2000) also showed that T-units were significantly lower for children with language learning disabilities than for an age control group, while the number of grammatical errors were higher. Grammatical error analysis looks at misuse of tense, poor subject-verb

agreement, failure to mark plurals, possessives, and other inflections and use of nonstandard forms like '*ain't*' and '*I seen*' (Paul 2007).

Another index of syntactic complexity was suggested by Scott and Stokes (1995) called subordination index (SUB-I). Usually the subordination index is used to assess adolescent language samples and is an index of the density of clauses within sentences. Scott and Stokes define clause density as "a ratio of the total number of clauses (main and subordinate) summed across [T-units], and divided by the number of [T-units] in a sample" (p.310). Therefore, a T-unit that contains one main clause receives a clause count of 1. To calculate the subordination index, the number of clauses for each T-unit in the sample is added and then divided by the number of T-units. The subordination index assesses whether children use sentences that include "the syntactic characteristics of a literate language style" (Paul 2001, p.605). It was developed by Goldman-Eisler, Skarbek and Henderson (1965) as a measure of the degree of syntactic integration, and is described as "the proportion of subordinate propositions in the total number of propositions (proposition being a group of words in grammatical sequence, dependent upon a verb, and making complete sense)" (Goldman-Eisler et al 1965 p. 86).

Section 1.2: IGDs in disordered populations

Scarborough, Rescorla, Tager-Flusberg, Fowler, & Sudhalter (1991) investigated language samples of normal preschoolers and adolescents to examine MLUm as a predictor of grammatical complexity in children with delayed language, Fragile X syndrome, Down syndrome, and autism. Another measure, The Index of Productive Syntax (IPSyn), which served as a measure of syntactic and morphological proficiency, was used to make a comparison between the two measures for these disordered

populations. The authors found that MLUm and the IPSyn were related in development: "For all groups, a strong curvilinear association (relationship between the two variables is irregular in both slop and direction and therefore the graph bends) between measures was found across the MLU range from 1.0 to about 4.5. Correlations were weaker when MLU exceeded 3.0 than during earlier stages of language development" (Scarborough et al 1991, p.23). This confirms other studies that have suggested that MLU becomes less closely associated with grammatical development as linguistic proficiency increases and that this association holds not only for typically-developing children, but also for atypical populations.

Other studies mainly focused on children with specific language impairment (SLI). Although these children show significant limitations in language ability, other problems that usually accompany language learning problems are not evident. For example, hearing impairment, low non-verbal intelligence test scores, and neurological damage are not seen in children diagnosed with SLI. The typical range of SLI prevalence estimates was between 2% and 8% with an overall median prevalence of 5.95% (Law, J., Boyle, J., Harris, F., Harkness, A. & Nye, C., 2000a). In Children with Specific Language Impairment, Leonard (2000) explains that SLI is seen more in males than females and that frequently these children have siblings or parents with a history of language learning problems. Children's language learning improves with treatment but they are also at risk for developing reading disorders like dyslexia, when reaching school age.

Diagnosing SLI is based on exclusionary and inclusionary criteria. "A diagnosis of a language problem can usually be made with confidence. The trick is to distinguish

SLI from other disabling conditions…" (Leonard 1997, p. 10). These are the criteria for SLI (Leonard 1997, p. 10):

1. Language ability – Language test scores of -1.25 standard deviations or lower; at risk for social devalue
2. Nonverbal IQ – Performance IQ of 85 or higher
3. Hearing – Pass screening at conventional levels
4. Otitis media with effusion – No recent episodes
5. Neurological dysfunction – No evidence of seizure disorders, cerebral palsy, brain lesions; not under medication for control of seizures
6. Oral Structure – No structural anomalies
7. Oral Motor Function – Pass screening using developmentally appropriate items
8. Physical and Social Interactions – No symptoms of impaired reciprocal social interaction or restriction of activities

Oetting and Hadley (2009) review studies that relate to the broad categories of deficits, assessment tools, and intervention methods. Oetting and Hadley explain that children with specific language impairment (SLI) have lower than expected MLU with limited use of grammatical morphology. They add that lower MLU is a very significant indicator of delayed growth. Difficulties with finite verb morphology become more pronounced in children with SLI in ages five through eight (Bishop, 1994; Conti-Ramsden, 2003; Krantz & Leonard, 2007; Leonard, Deevy, Miller, Rauf, Charest, & Kurtz, 2003; Leonard, Bortolini, Caselli, McGregor, & Sabbadini, 1992; Oetting & Horohov, 1997; Owen & Leonard, 2006; Marchman, Wulfeck, & Ellis, Weismer, 1999; Redmond, 2003; Rice & Wexler, 1996; Rice, Wexler, &Cleave, 1995; Rice, Wexler, Hershberger, 1998). Usually the finite verb morphology involves errors of omission. For example a child might say '*He walking*' or '*Everyday she dance*.' Errors of commission for example, '*He am walking*,' are rarely seen (Cleave & Rice, 1997; Eadie, Fey, Douglas, & Parsons, 2002; Leonard et al., 1992; Rice et al., 1995). Even though children

with SLI omit finite verb morphology, other aspects of their morphological systems seem to be intact. In fact, after eight years of age, it is even harder to distinguish children with and without SLI using finite verb morphology (Conti-Ramsden, Botting, & Faragher, 2001). Again, this reiterates the importance of diagnosing SLI at an early age. Children with SLI overregularize the past, nominal plurals, and passive participle markers, but not more than normal controls (Leonard, Eyer, Bedore, & Grela, 1997; Leonard et al., 2003; Marchman et al., 1999; Oetting & Horohov, 1997; Oetting & Rice, 1993). In other studies including regular and irregular markers of plural and past tense, children with SLI seemed to perform similarly to the controls (c.f. Grela, Snyder, & Hiramatsu, 2005; Jacobson & Schwartz, 2005).

Section 1.3: IGDs in Spanish

Since MLU was developed for English, there needs to be certain adaptations for other languages. Spanish is a more highly inflected language than English and Linares & Sanders (1977) provide an example of adapting MLUm to Spanish. They conducted a study with 30 normal and 30 language-impaired three-year-old Puerto Rican children. These two groups of children were compared by using two measures of linguistic proficiency: mean length of utterance (MLU) and the Developmental Sentence Scoring procedure (DSS; Lee & Canter, 1971). Diagnostic measures for evaluation of language in Spanish-speaking children has largely consisted of unstandardized translations of tests into Spanish developed for English-speaking children living in the US. Due to the lack of information, according to Linares and Sanders, especially for language impaired children, the clinical evaluation of language has been hindered in terms of effective language intervention and research on language acquisition for Spanish-speaking children.

To determine MLUm, Linares and Sanders followed a general rule that inflections were counted as separate morphemes if children used the correct inflection and if they used it contrastively. This is to say that the children would receive credit for using a feminine gender ending only if they used a contrastive masculine gender ending for the same word at a different time. The use of the contrastive form suggests that a child had acquired knowledge of the morphological rule for this dimension of language, rather than just learned the word as an unanalyzed whole. This method is a Spanish adaptation of MLUm, because English does not have gender endings morphemes that contrast. Linares and Sanders add that MLU is considered a good research instrument, but normative data is not available for clinical use. The DSS on the other hand, was described by Lee (1974) as "a method for making a detailed, readily quantified and scored evaluation of a child's use of Standard English grammatical rules… (which) provides a way of measuring a child's growth and progress throughout the period of clinical teaching" (Linares & Sanders, 351). Results showed that both DSS and MLU were able to distinguish the two populations (normal and language impaired children) within the three year age range.

Aguado (1988) examined mean length of utterance in words (MLUw) to determine if it was a good measure of morphosyntactic complexity in Spanish-speaking children. He was especially interested in 2 ½ year old children because this is considered to be the key age to be the first syntactic expansion. His study is based on an adaptation of the Northwestern Syntax Screening Test (NSST; Lee, 1971) for children from 3 years old and up. According to Aguado, "…items to explore morphosyntactic signs missing from the English language but present in Spanish have been added…" (p. 94). A variety of morphosyntactic elements were studied and grouped into thirteen categories:

interrogative, negative, sentence models (subject-verb models), coordination, subordination, gender and number, articles, demonstrative adjectives, pronouns, verbs, adverbs, prepositions, and conjunctions. There was a correlation between the grammatical richness (the sum of morphosyntactic elements found in each child) and MLU. Due to these results, it was found that MLUw is indeed a valid measure of grammatical richness in Spanish.

Other uses of MLU and other IGDs in Spanish are found in Castilla (2008), which addressed two general language measures: a standardized receptive vocabulary measure (Test de Vocabulario en Imágenes, TVIP – a Spanish adaptation of the Peabody Picture Vocabulary Test, Dunn & Dunn 1997), and a parental report of speech and language problems. Also, morphosyntactic measures of language development were used in both story retelling and an elicitation task. She used developmental language measures such as number of T-units (NU-TU), mean length of T-units (MLTU), the subordination index (SUB-I). Grammatical errors per T-unit (GRE-TU) were derived from the narratives of the Colombian children she studied. She discussed a subordination index measure that has not been explored very much. The Subordination Index is the number of dependent and independent clauses (complex sentences) divided by the total number of T-units. The subordination index has been shown to be sensitive to changes in language development (Paul, 2001). A SUB-I score of one indicates that children used only simple sentences when talking. As children mature, their scores on the language task increased and their omissions of direct objects and determiners decreased. These developmental patterns represent typical language development and suggest that the developmental paths of direct object pronouns and determiners occur with comparable timing.

Castilla's research also offered data on the productive use of object pronouns, articles, adjectives and plurals across the preschool years. The language battery used in her research showed sensitivity to developmental changes between 3 year olds and 4-5 year olds and Castilla believes that it has the potential to be used as an eventual diagnostic tool for the identification of children with language disorders. Speech-language pathologists who work with Spanish-speaking children may be able to use this normative information to conduct more objective language assessments, since there are not many good measures and diagnostic tools for Spanish-speaking children.

Castilla follows Dethorne, Johnson, and Loeb (2005) who assert that the development of MLU can be influenced by various language domains. Their results with children from 2;4 to 3;1, measured in terms of MLU, agreed with the idea that productive syntax shared variance with lexical diversity. Castilla explains that "while productive vocabulary (Number of Different Words; NDW) was associated with utterance length, receptive vocabulary (Peaboby Productive Vocabulary Test) had very low correlations with both MLU and NDW" (Pérez-Leroux, Bruner & Castilla under submission, p. 8). She also states that both MLTU and SUB-I are moderately correlated with receptive vocabulary and strongly correlated with expressive vocabulary. Through Castilla's study, they found that there is a strong correlation between MLTU and NDW and these results suggest "not only general associations between vocabulary and sentence complexity measures, but also specific associations between productive measures and sentence complexity when we control for developmental factors" (Pérez-Leroux, Bruner & Castilla under submission, p.15). Within the Pérez-Leroux et al study, Dethorne et al (2005) is quoted as saying that "the robust association between MLU and NDW is

mediated by factors exclusive to production, so that the association is not between grammar and vocabulary but between two productive modalities" (Pérez-Leroux, Bruner & Castilla under submission, p.18). Had the Pérez-Leroux et al study only look at general measures, they would have agreed with Dethorne et al in favor of the Unified Hypothesis. However, they added a new component in which their hypothesis stated that "vocabulary would be differentially implicated in the results of different specific grammar measures. The crucial difference was established on learnability grounds" (Pérez-Leroux, Bruner & Castilla under submission, p.18). Therefore, Pérez-Leroux et al explain that the associations made during this study are not just between two productive modalities, but between both productive and receptive modalities.

Section 1.4: IGDs in Spanish SLI

Gutiérrez-Clellen, Restrepo, Bedore, Peña & Anderson (2000) address the methodology for spontaneous language sample analysis in Spanish-speaking children, with a focus on Spanish-English bilinguals in the US. They looked at a variety of language assessment procedures based on spontaneous language samples. Also Gutiérrez-Clellen et al. discuss methodological issues related to the Developmental Assessment of Spanish Grammar (DASG), mean length of response in words (MLR-w). Also, measures of Spanish grammar with diagnostic potential were proposed. Initially they explain some of the main difference between English and Spanish. For example, Spanish verbs are inflected for tense, person (first, second, third), number (first person singular, first person plural, etc.), mood (subjunctive, indicative), and aspect (imperfect, perfect). These inflections vary according to the verb stems since all verbs end in –ar, –er, or –ir. On the other hand, English verbs inflections do not change for person (except

for 3rd person singular –s), mood, or aspect (which is marked with auxiliary verbs). English only has one regular inflectional marker for past (-ed), while Spanish marks past, present, and future tenses with different inflections. Gutiérrez-Clellen et al argue that because these two languages have many differences, it is inappropriate to apply the same techniques of spontaneous language measure analysis on Spanish speakers based on monolinguals English speakers.

Gutiérrez-Clellen et al (2000) consider a range of IGDs in the existing literature. These include errors per T-unit, as well as MLUw and MLTU. MLUw research had already been conducted with preschool-aged monolingual Spanish speakers which found that MLUw correlated significantly with the number of morphosyntactic elements (Aguado 1989). Gutiérrez-Clellen and Hofstetter (1994) adapted Hunt's T-unit analysis to Spanish for MLTU. Conjoined subjectless sentences were counted as separate T-units in Spanish because it is a pro-drop language while English is not (Gutiérrez-Clellen et al 92).

As discussed above, Linares and Sanders (1977) adapted Brown's rules for MLUm in Spanish. Many problems that stem from the inflected nature of the Spanish language arise using MLUm. Linares and Sanders counted all inflections that a child used correctly and contrastively as separate morphemes. In Linares (1975), his rules stated that one must "count how many bound morphemes (inflections) appear in the utterance and add this total to the one for "a". Count only correct inflections and if the child gives evidence of knowing the alternative inflections for the particular root" (p. 171). Therefore, in terms of gender differences for nouns, then generic ending –a (feminine) or –o (masculine) are counted as 1 morpheme only when the root can have

different generic endings (i.e. *gato* and *gata* are both possible words and each receive a morpheme count of 2, but *luz* only counts as 1 morpheme because it has no gender since *luza* does not appear in Spanish) (p. 171). Thus, children were given credit for a morpheme in their MLU calculations when it had been used contrastively in their 100 utterance recording sessions. An obvious problem with this approach is that in 100 utterances per child, there may not be an opportunity to use a given morpheme contrastively. The result of this absence of opportunity is that MLUm measures that use contrastiveness as a criterion are likely to underestimate what children know. Further, children who simply produce more speech are likely to get more credit for morphological development than those who produce less speech, independently of their morphological development, simply as a function of greater opportunities to produce contrastive uses of morphemes.

Gutiérrez-Clellen et al (2000) describe how different attempts to calculate MLUm in Spanish (e.g. Linares and Sanders 1977 and García 1978) have adopted very different assumptions about how to best do this and how some of them make unmotivated assumptions about what children know. Specifically, both García (1978) and Linares and Sanders (1977) give children credit for grammatical dimensions that may not be overtly marked on a particular form. For example, Linares and Sanders would give credit for indicative mood marking on a present tense verb, which marks indicative mood by means of a zero morpheme. While Linares and Sanders (1977) do this in both the nominal and the verbal domain, García (1978) does this just in the nominal domain. Gutiérrez-Clellen et al (2000) continues to say that "neither of the counts distinctively capture differences in grammatical complexity between early occurring forms such as third singular present

tense, and less common forms, such as third person plural present subjunctive (p. 93). Furthermore, "the methodological problems discussed thus far relate to the fact that procedures for determining grammatical complexity were designed to parallel those designed for English without taking into account the characteristics of Spanish morphology" (Gutiérrez-Clellen et al p. 93). This methodological problem is seen clearly in García's procedure. He created a single rule for the analysis of all irregular forms. Some irregular forms in Spanish such as *fue* and *sé* seem comparable to English forms such as *went* and *made*. Sometimes Spanish forms have irregular stems (*tener* and *poner*) and irregularities in inflectional markers. Others have irregularities in the formation of stems across the verb paradigm but use regular morphological markers (*volver* and *sentir*) (Gutiérrez-Clellen et al p. 95). This article further states that since there is a lack of developmental norms in Spanish, these measures are rendered less useful than their counterparts in English.

Gutiérrez-Clellen et al conclude that "MLUw appears to be the most satisfactory measure (in Spanish or English language samples). Further explaining that "although MLUw is not established by counting inflectional morphemes, it is still affected by differences in inflectional complexity across the two languages." (p. 96). They continue to explain that since there is a limitation of available language measures, it is important to examine language performance using a variety of approaches. For measuring syntactic and morphological complexity they suggest DASG or MLUm (Linares and Sanders 1977), and number and type of grammatical errors to analyze the quality of the children's utterances.

Section 1.5: Tense and SLI in English and Spanish

Rice, Wexler, & Hershberger (1998) explain that tense marking in English appears relatively late, especially in children with SLI. They found that nonsyntactic measures are not predictors of growth (including nonverbal intelligence, vocabulary size, and mother's education), but initial MLU does predict rate of acquisition. Their findings supported the model of Optional Infinitives (OI; Wexler, 1990) for typically developing children and Extended Optional Infinites (EOI; Rice & Wexler, 1996) for children with SLI. The EOI period seems to be an extended parallel to a period of immature grammar of the OI stage. In English, since the infinitive is a bare stem, the OI stage is shown by children's tendency to drop certain morphemes like third person singular *–s* (ex. She walks), past *–ed* (ex. She walked), and copular and auxiliary forms of '*be*' and '*do*.' "The interpretation is that these morphemes share the grammatical property of tense marking. Optional use of morphemes within this set is attributed to an incomplete specification of grammatical tense in the children's underlying grammatical representations" (Rice et al 1998, p. 1413). Rice et al (1998) were able to differentiate affected children from their younger language-matched counterparts through an elicited production task involving particular these morphemes.

As a follow up to the previous study, Rice, Wexler, & Redmond (1999) show that children's grammatical judgments parallel their productions. Children with SLI make grammatical judgments to accept morphosyntactic errors that they are likely to produce and to reject morphosyntactic errors they are unlikely to make. This study again supports the EOI based on underlying grammatical representations and do not support accounts of input processing deficits or production constraints.

Many studies on Spanish have shown that children have the most difficulty in the nominal domain, especially in regards to direct object clitics and articles (Bedore & Leonard 2001). Omission is the most common error type as children with SLI frequently omit articles and pronouns at significantly higher rates than both age and language-matched control groups. Bedore and Leonard (2001) show that plural marking on nouns and noun/adjective agreement may be problematic for Spanish-speaking children with SLI.

Using an elicited production task, Bedore & Leonard (2001) examine a variety of aspects in the morphology of Spanish of children with SLI and include the types of errors in their results. In the study, significant differences are seen between SLI children and control groups in the areas of direct object pronouns, noun plurals and noun-adjective agreement for number and gender. They conclude that verbal morphology is not problematic for Spanish-speaking children with SLI. In the verbal morphology portion of the elicited production task, Bedore & Leonard (2001) elicited first and third person, singular and plural, present and past tense verbs. Their analysis shows no significant differences in the errors made by children with SLI and their language and age controls.

However, Grinstead, Pratt, De la Mora & Flores (2009) show that in Bedore & Leonard's results, the three most common types of errors were substitution errors of the bare stem *canta*, infinitive *cantar*, and third person singular past perfect *cantado.* By looking at the distribution of the types of errors by group, they are able to statistically differentiate the affected children from their language and age-matched control groups. They make this finding using the receptive Grammaticality Choice Task, of Grinstead & Pratt (2007). Grammaticality judgment tasks were pioneered by McDaniel & Cairns

(1990), McDaniel, Chiu & Maxfield (1995) and usually ask for children to make judgments on sentences that are either grammatical or ungrammatical. Modifying this format, and adapting the design of Rice et al (1999), Pratt & Grinstead (2008) present a grammaticality judgment experiment where children with both the child-particular form (ex. a nonfinite verb) as well as the adult-like form (ex. a finite verb) and asking children to choose between them. They call this modified task, "Grammaticality Choice Task" and argue that this format reduces the processing burden on the children and shows that children of the same age, tested on the same construction improve their scores, relative to their scores on a standard grammaticality judgment task. Some investigators have proposed that children with SLI may have reduced language processing abilities (e.g. Katz, Curtiss & Tallal 1992) and so this grammaticality judgment experiment is meant to reduce the processing demands for the children. Grinstead et al (2009) also argue that spontaneous production data is not the best source of information on verb finiteness in null subject languages like Spanish. They suggest that a receptive measure of children's language competence is a better way to access whether there is or is not an optional infinitive stage in child Spanish. Once again, Grinstead et al propose and show that the receptive measure, Grammaticality Choice Task, does indeed distinguish children with SLI from age and language-matched controls in finiteness marking. Also, the Grammaticality Choice Task shows that a receptive measure (not just spontaneous production data) can overcome the limitations of a null subject language with portmanteau tense-agreement morphology.

Summarizing, there is evidence that child Spanish speakers with SLI can be distinguished by virtue of their knowledge of tense marking, as in English and other

languages. Other research has shown that a range of IGDs derived from spontaneous speech may also be useful for this purpose, when the language-particular properties of Spanish are taken into account. In what follows, samples of children who have had receptive and expressive tests of tense marking will be studied to determine to what degree IGDs calculated from their spontaneous speech can be useful diagnostic tools for distinguishing children with SLI from those without it. Apart from this clinical goal, children's IGD scores will also be examined for the basic scientific purpose of determining whether, and to what degree, children's tense scores correlate with these IGDs.

Section 1.6: Research Questions

Based on the findings and theories previously discussed, the following research questions are considered:

1. Can spontaneous measures of monolingual Spanish distinguish typically-developing children from children with specific language impairment?
2. If so, which measures are most effective?
3. Do spontaneous measures (IGDs) of TD and SLI groups of children who took grammaticality choice and elicited production tests of tense correlate with those test results?
4. Can Discriminant Function Analysis be used to tell us which of these measures or combinations of measures yield the best sensitivity and specificity distinctions of the children in the sample?

Chapter 2: Methods

Section 2.0: Participants

There are 55 participants in this study. There were transcripts of two groups of monolingual Spanish-speaking children from Mexico City, one with SLI and the other a group of typically-developing children of the same mean age as the SLI group. Ages range from 3;10 to 6;10. In the sample of 55 children, all were recorded producing 20-35 minutes of spontaneous, mostly narrative speech. A subset of these children took the grammaticality choice task measuring their acceptance of root nonfinite verbs in Spanish (SLI n = 21, TD n = 25). This test is described in Grinstead, De la Mora, Pratt & Flores (2009). Another subset of the 55, took an elicited production test of verb finiteness (SLI n = 18, TD n = 18). A smaller subset took both of these tests (SLI n = 13, TD n = 14). These last two groups are described in Grinstead, De la Mora, Vega-Mendoza & Flores (2009).

Section 2.1: Grammaticality Choice and Elicited Production Tests

Grinstead, De la Mora, Pratt & Flores (2009) tested a group of monolingual Mexican Spanish-speaking children who had been diagnosed with SLI. This group was statistically worse at identifying the finite verb in a finite vs. nonfinite grammaticality choice task than either age-matched or language-matched controls. Grinstead, De la Mora, Vega-Mendoza & Flores (2009) gave both an elicited production test of verb finiteness and a grammaticality choice test of finiteness to a group of typically-developing children, whose scores on both tests correlated. They also tested a group of children with SLI with the elicited production task, who were statistically worse than an

age-matched control group. What follows are brief descriptions of both tasks. Please consult the original studies for further detail.

Grammaticality Choice Task:

There were 25 typically developing (age range = 3;1 – 6;7, mean age = 5;2) and 21 SLI children (age range = 4;10 – 6;4, mean age = 5;7). Children were shown a picture of two animals sleeping and then puppets corresponding to each of the two animals sleeping in the picture produced either a finite (e.g. *Yo duermo*. "I sleep.") or a nonfinite (e.g. *Yo duerme*. "I sleeps.") Spanish verb. Children were then asked to choose the puppet who said it best. 17 statements were presented to each child and their scores were recorded. Within the test there were 5 "filler" statements. These statements were included in the test to see if children understood the task they were being asked to perform. If the child answered correctly to at least 3 of the 5 fillers, their overall score was accepted. If the children answered less than 3 of the fillers correctly, their overall score was not considered in this study.

Elicited Production Test:

There were 18 typically developing children (age range = 4;10 – 6;4 , mean age = 5;5) and 18 SLI children (age range = 4;10 – 6;10, mean age = 5;9). Children were given a statement and then they had to fill in the blank to a very similar statement. For example, if the investigator said "*Yo pinto y tú* ____." The correct response is "*pintas*." 15 statements were presented to each child and their scores were recorded. Again, there were 5 filler statements of which the children needed to answer 3 correctly in order for their score to be considered in this study.

Section 2.2: Grammatical Measures of Spontaneous Production

In calculating all IGDs, the conventions established by Brown (1973) for calculating MLUm were followed, repeated here, with some differences that are discussed below.

1. Include all exact utterance repetitions. Stuttering is marked as repeated efforts at a single word; count the word once in the most complete form produced. In the few cases where a word is produced for emphasis or the like count each occurrence.
2. Do not count such fillers as mm or oh, but do count no, yeah, and hi.
3. All compound words (2 or more morphemes), proper names, and ritualized reduplications count as single words.
4. Count as one morpheme all irregulars of pasts of the verb.
5. Count as one morpheme all diminutives because these children at least do not seem to use the suffix productively. Diminutives are the standard forms used by the child.
6. Count as separate morphemes all auxiliaries. Also all catenatives: gonna, wanna, hafta. These latter counted as single morphemes rather than as going to or want to because evidence is that they function so for the children. Count as separate morphemes all inflections, for example, possessive, plural, third person singular, regular past, progressive.
7. The range count follows the above rules but is always calculated for the total transcription rather than for 100 utterances.
8. Words also omitted from each measure included: mhm, um, uh, eh, ay, ejm, and este (when used as a filler).

Number of Different Words measure was calculated by the CLAN program from CHILDES (MacWhinney 2000). The program counted how often each word was used and how many different words there were in each transcript.

Mean Length of Utterance in words was also calculated by the CLAN program. Every word in each child utterance was calculated and then averaged.

Type-token ratio was calculated by the CLAN program. The number of words is totaled (tokens) and then divided by the number of different words produced (types).

Mean Length of Utterance in verb phrases was calculated by omitting the explicit subject of a sentence if present. For example if a child said "el otro tigre no quiere ayudar." In this instance, "el otro tigre" is the subject, so it would be omitted from the calculation of MLUvp. Each child utterance was calculated and then averaged. The use of MLUvp was predicated on the suspicion that the null subject nature of Spanish might make an MLU calculation that included subjects susceptible to variance from another domain of language, namely, discourse pragmatics, as opposed to strict morphosyntax.

Mean Length of Utterance in morphemes was calculated by counting morphemes of each child utterance. Particular attention was given to how the child pronounced the words instead of what the transcriber thought the child said. For every transcript, each child utterance was calculated and then averaged. Suppletive forms were treated as 1 morpheme. For example, *No sé* was considered 2 morphemes. Fillers and stutters were not included. Repetitions were included. All infinitives were considered 3 morphemes, including *ser*. In verbs, the root, the theme vowel (if present), and inflectional morpheme were counted. For example, *cantaron* (cant-a-ron) is 3 morphemes and *cantábamos* (cant-a-ba-mos) is 4 morphemes. '*A ver*' and '*mira*' were assumed to be single lexical items so they were counted as 1 morpheme. Diminutives were considered separate morphemes (ex. *pecesitos* – pec-esito-s) 3 morphemes because children use the suffix productively. *Al* and *del* are 2 morphemes since they are contractions of 2 words. Lastly

if there is a foreign word, it is counted as one morpheme since they presumably consider these words as 1 morpheme and do not know how to use any included suffixes productively. For example, the name of the movie "Cars" was counted as 1 morpheme.

Mean Length of Terminable Unit was calculated by counting words per Terminable Unit (T-Unit). A T-Unit contains one independent clause and any dependent clauses. A clause must have a subject and predicate. For example, "Bill bought a new bicycle before he went to Europe". This is considered 1 T-unit that includes an independent clause (Bill bought a new bicycle) and a dependent clause (before he went to Europe). On the other hand, "Bill went to France and then he went to Italy" is considered 2 T-units because there are 2 independent clauses joined by the coordinating conjunction "and." Whenever a coordinating conjunction (and, but, so) initiates an independent clause, that clause is considered to be a NEW T-unit. Conjoined subjectless sentences are not counted as separate T-units in English, but are in Spanish because of its null subject nature, which allows a conjoined subjectless clause to have a subject distinct from the first clause (e.g. "Quieren salir pronto y estoy de acuerdo."). Fragments are not considered T-units since it must be a sentence with a verb and explicit or implicit subject. Also, any utterance with unintelligible speech is not considered in the analysis. Errors per T-unit was calculated by counting the number of errors per T-unit.

The Subordination Index (SUB-I) is calculated by making a ratio of the total number of clauses to the total number of T-units. SALT guidelines were used for calculating SUB-I. Utterances that are incomplete or unintelligible were excluded from the SUB-I analysis. When an elliptical response to a question is not a clause, it was not included. For example, [Se subió a la piedra] [y cayó de la piedra] are 2 separate clauses

so there are 2 SUB-Indexes. Also, [Luego corrió] [y miro] is considered 2 clauses and therefore 2 SUB-Indexes. Infinitives were not counted as clauses. For example: The boy told the dog to be quiet is considered 1 SUB-I.

Section 2.3: Reliability

All of the transcripts were evaluated in the same way for each measure. Each transcript was transcribed by a native Mexican Spanish speaker of Mexico City, the dialect of the children in the study. Reliability testing was done for each of the IGDs by two native Spanish speakers for all transcripts (excluding NDW, MLUw, and TTR which were calculated by the CLAN program from CHILDES). The two scores were then averaged and they had an overall 98.73% agreement between them, across all measures.

	Reliability	
IGD	Mean (%)	Range (%)
MLUvp	99.3	91.4-100
MLUm	98.9	96.3-100
MLTU	99.28	91.3-100
Error/TU	97.42	87-100
SUB-I	98.74	69.33-100

Table 2.3 – Reliability of IGDs

Chapter 3: Study 1 - IGDs and Grammatical Measures

Section 3.0: Elicited Production Correlations

The graphs below show to what degree each of the eight spontaneous measures correlate (or do not correlate) with the expressive elicited production test (Grinstead et al) of verb finiteness. The elicited production test correlates with 7 of the 8 measures. The IGDs can be viewed as points along a spectrum that measures lexical vs. grammatical knowledge, though where the line should be drawn is less than clear. NDW and TTR are both considered more lexical measures which correlate with this expressive language test. MLUw, MLUm, MLUvp, MLTU, and SUB-I are considered more syntactic measures that all correlate with the EP test as well. Errors/TU is a measure that seems to be a mixture of both lexical and grammatical complexity which does not correlate with the EP test.

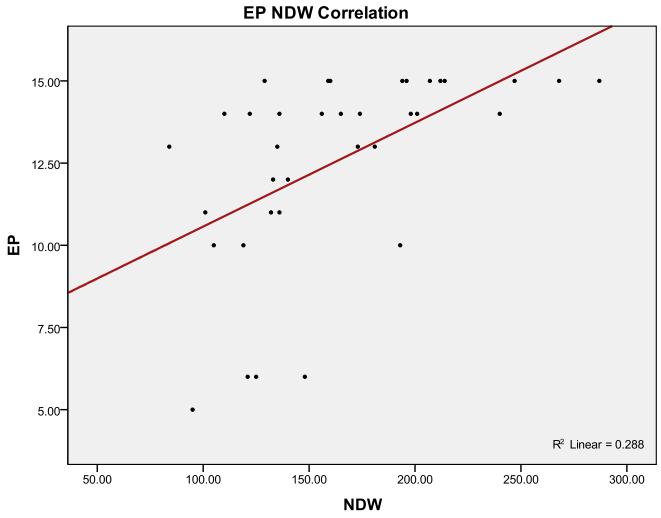


Figure 1

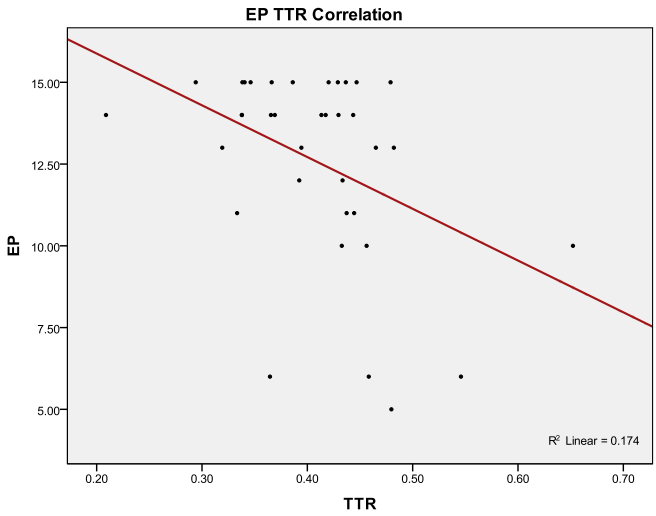


Figure 2

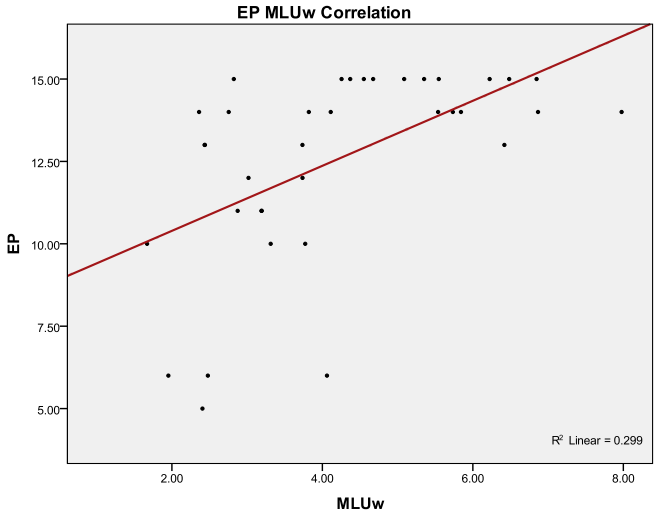


Figure 3

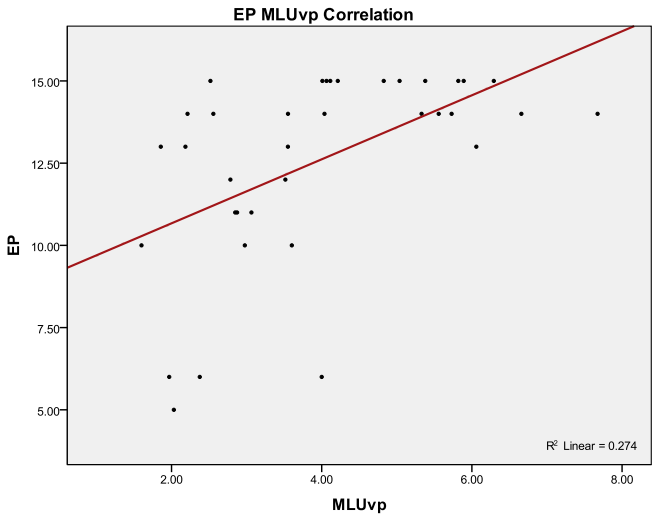
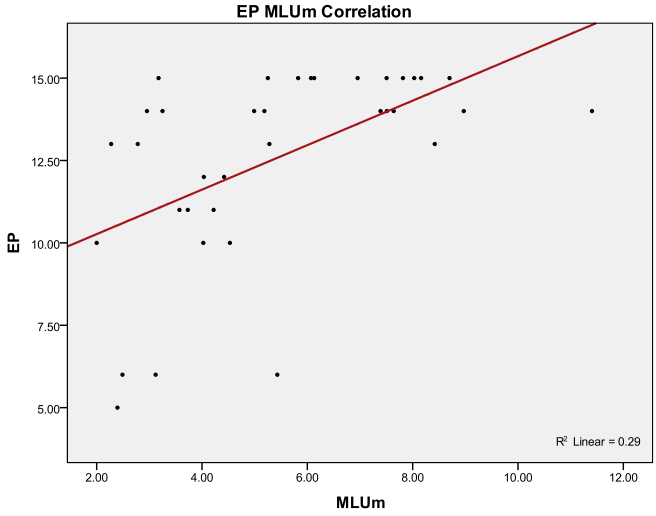


Figure 4



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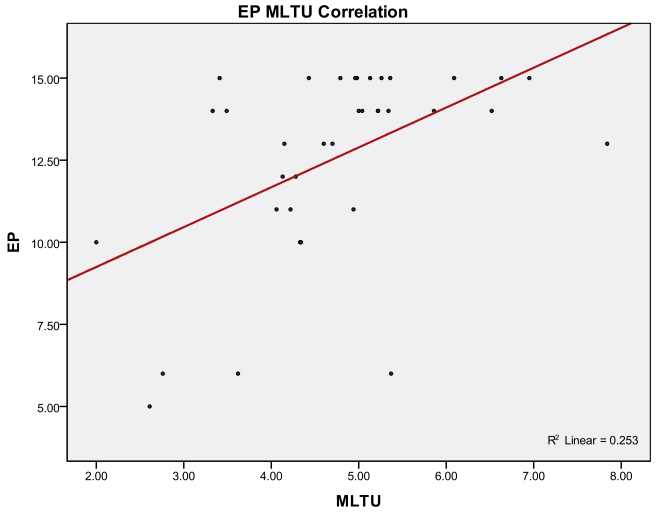

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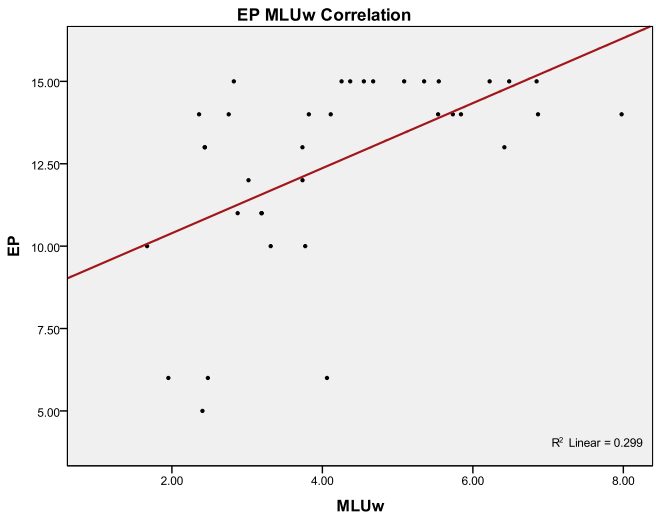

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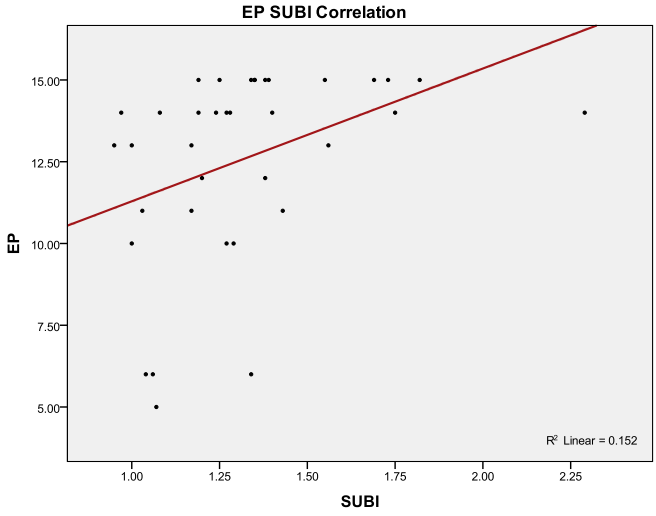


Figure 8

	EP Correlation	
IGD	r^2	p-value
MLUw	**0.299**	0.001
MLUm	**0.29**	0.001
NDW	0.288	0.001
MLUvp	0.274	0.001
MLTU	0.253	0.002
SUB-I	0.152	0.019
TTR	0.174	0.011
Errors/TU	0.035	0.277

Table 3.0 – Correlation between EP and each spontaneous measure

The table above summaries all of the measures and their degree of correlation to the elicited production test. The two highest EP correlations are MLUw and MLUm (which are both considered measures of syntactic complexity, though they also correlated with our more lexical measures). The r^2 value is a measure of the proportion of variance shared by the two variables (EP + spontaneous measure).

Section 3.1: Grammaticality Choice Correlations

The graphs below show to what degree each of the eight spontaneous measures correlate (or do not correlate) with the Grammaticality Choice Task (Pratt et al). The Grammaticality Choice Task correlates with 6 of the 8 measures. While NDW and TTR are both considered more lexical measures, NDW correlated with this receptive language task while TTR did not. MLUw, MLUm, MLUvp, MLTU, and SUB-I are considered more syntactic measures and they all correlate with the EP test as well. Again,

Errors/TU, the measure which is a mixture of both lexical and grammatical complexity, did not correlate with the GC test.

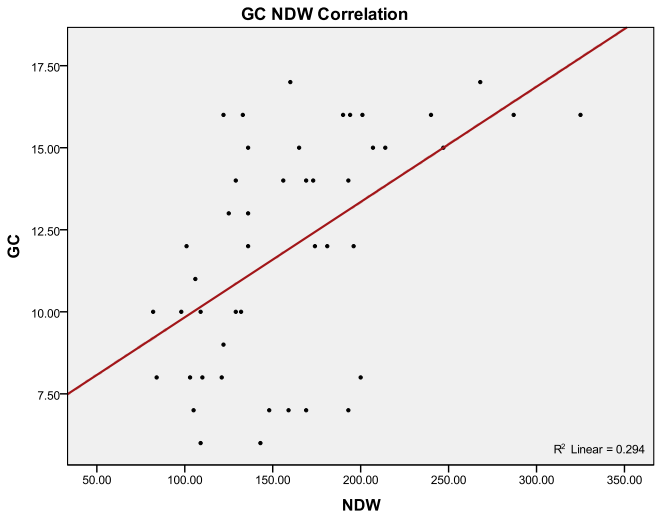


Figure 9

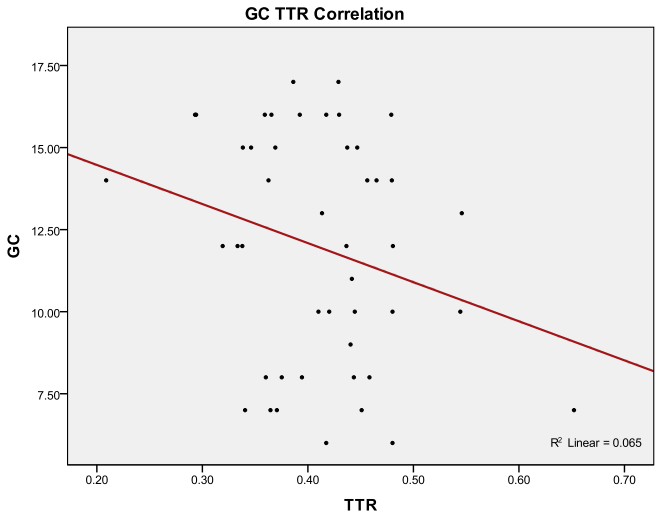


Figure 10

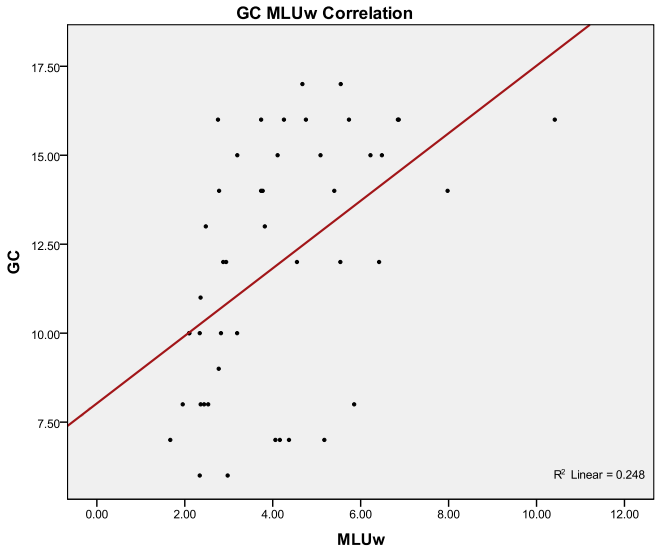


Figure 11

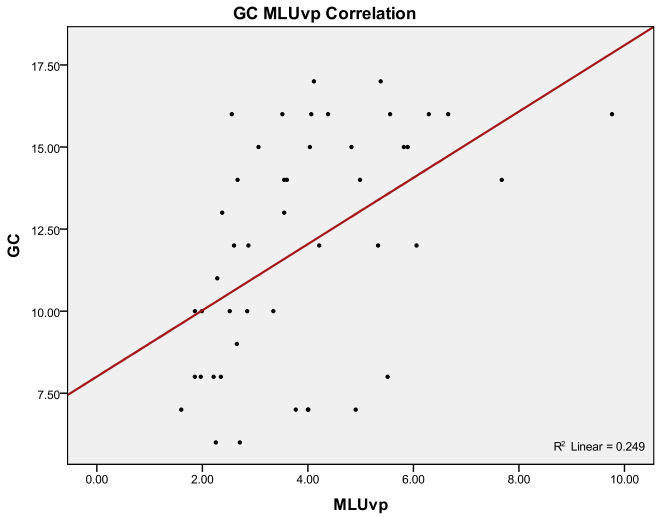
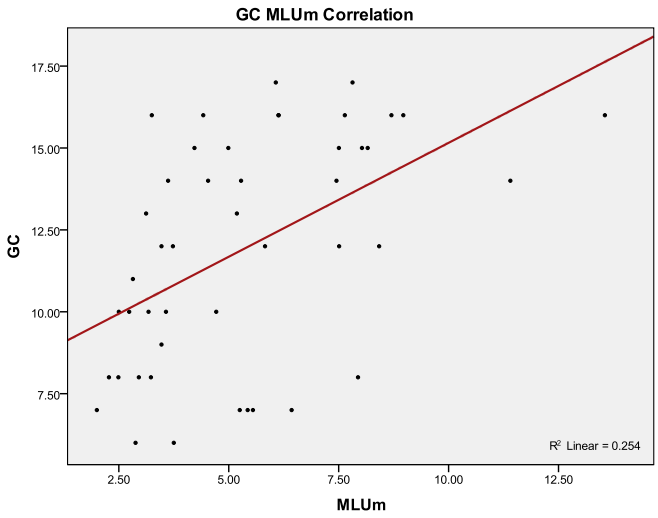


Figure 12



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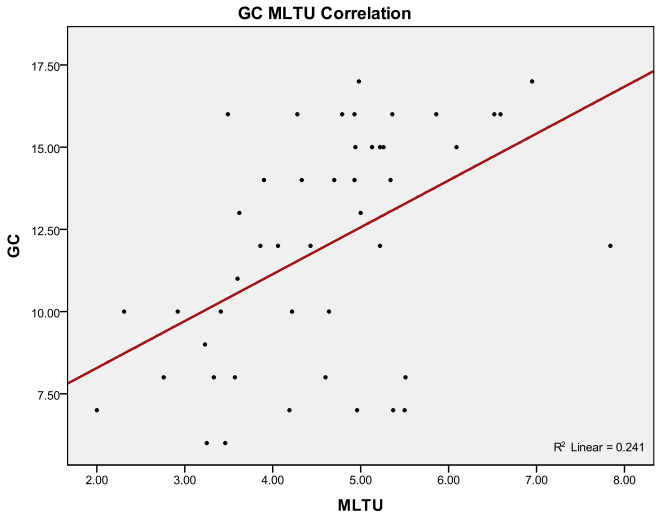

Figure 14

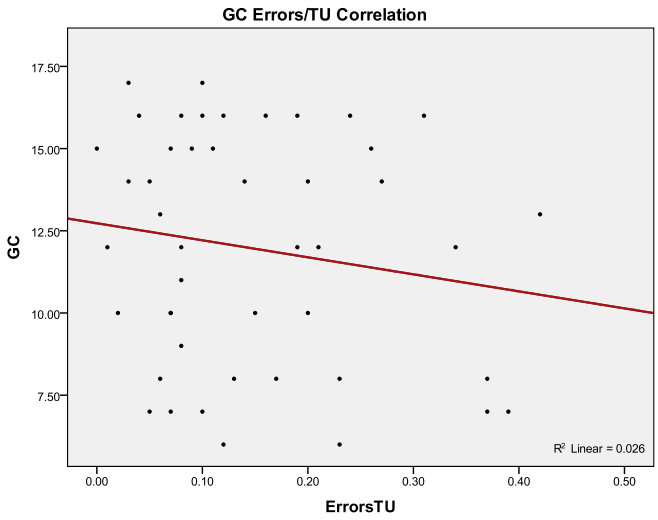

Figure 15

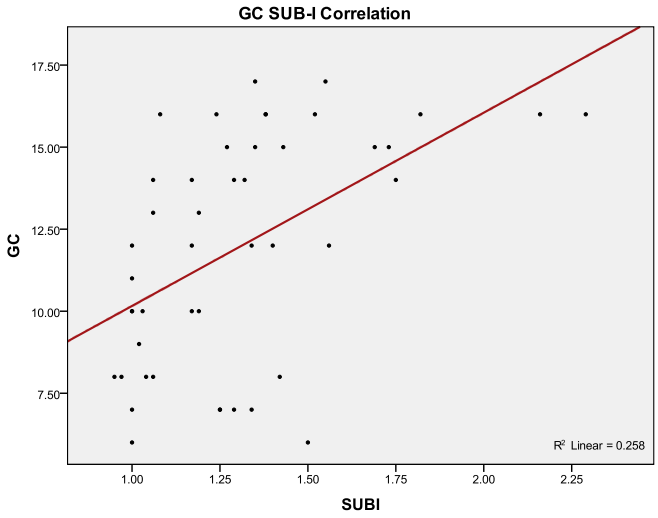

Figure 16

	GC Correlation	
IGD	r^2	p-value
NDW	**0.294**	<0.001
SUB-I	**0.258**	<0.001
MLUm	0.254	<0.001
MLUw	0.249	<0.001
MLUvp	0.249	<0.001
MLTU	0.241	0.001
TTR	0.065	0.086
Errors/TU	0.026	0.28

Table 3.1 – Correlation between GC and each spontaneous measure

The table above summaries all of the measures and their degree of correlation to the Grammaticality Choice Task. The two highest GC correlations are NDW (which is considered a more strict measure of lexical diversity) and SUB-I (which is considered a more strict measure of syntactic complexity).

Chapter 4: Study 2 - IGDs and the Identification of Children with SLI

Section 4.0: Comparisons

Previous research has shown that the elicited production test and the Grammaticality Choice task can distinguish typically-developing from SLI children. The graphs below show whether and to what degree the individual spontaneous measures can also distinguish the two populations. Seven of the following measures significantly distinguish children with SLI from those without.

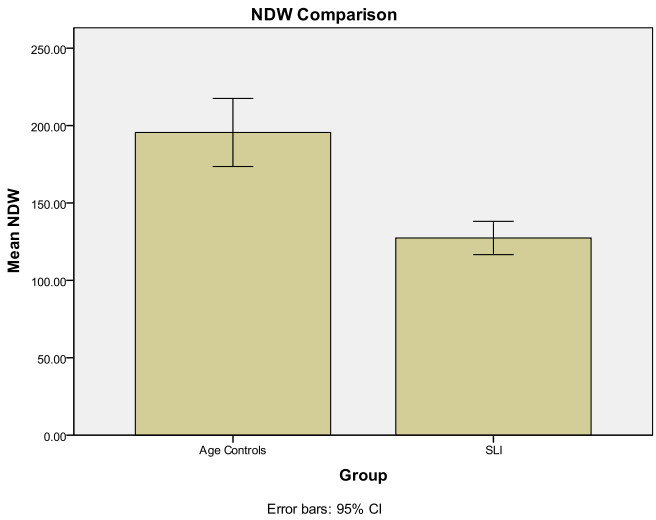

Figure 17

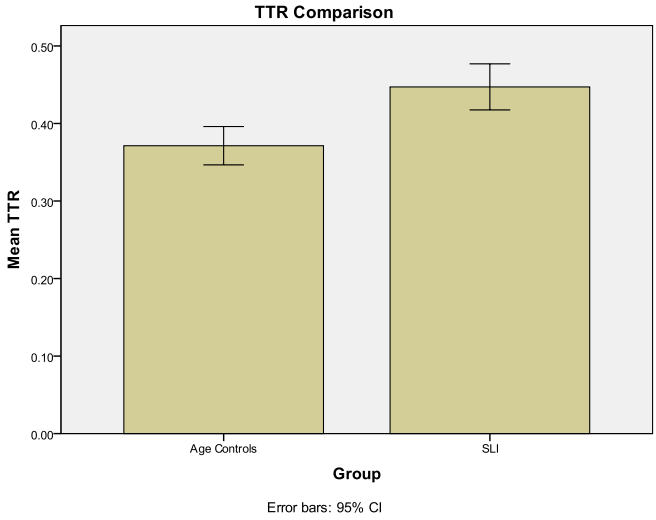

Figure 18

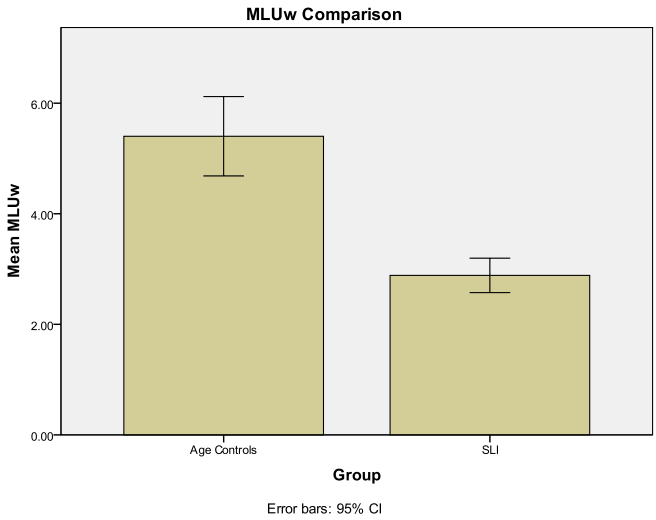

Figure 19

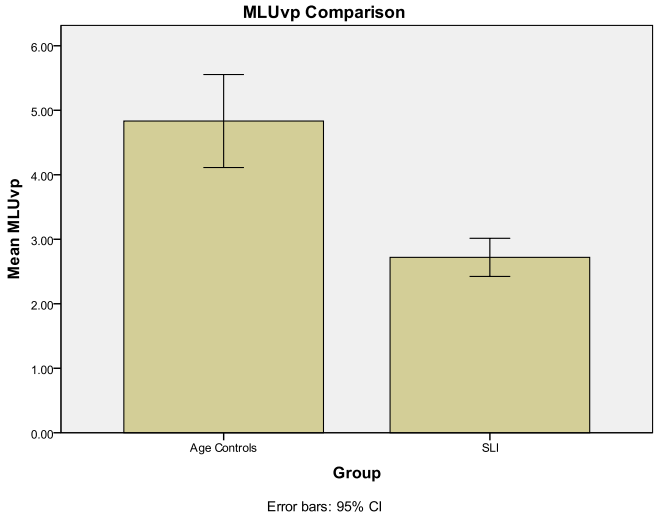

Figure 20

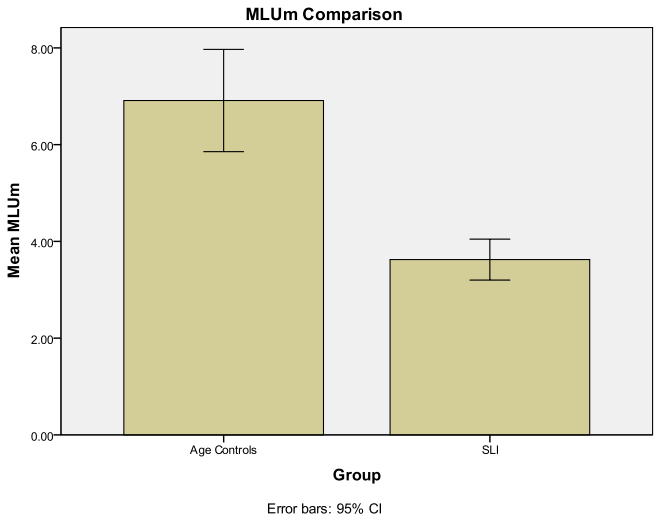

Figure 21

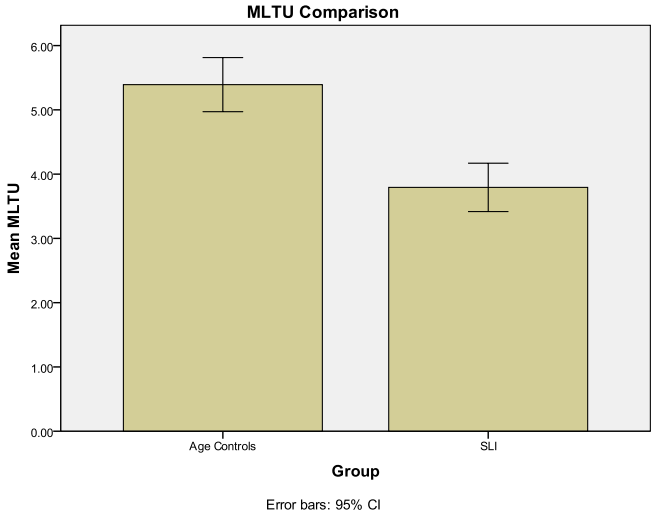

Figure 22

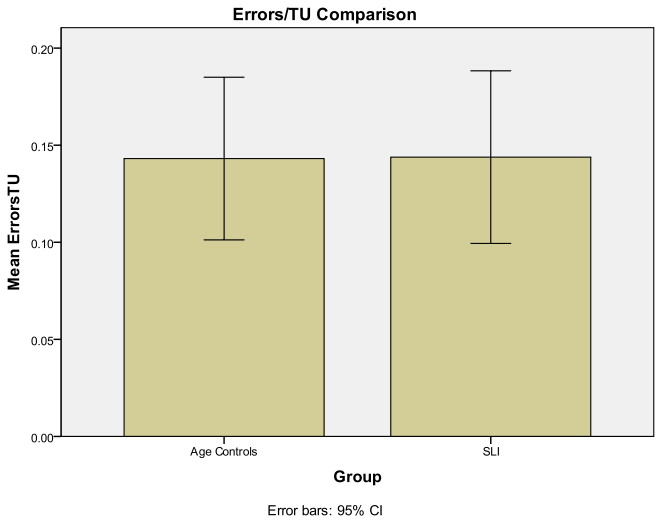

Figure 23

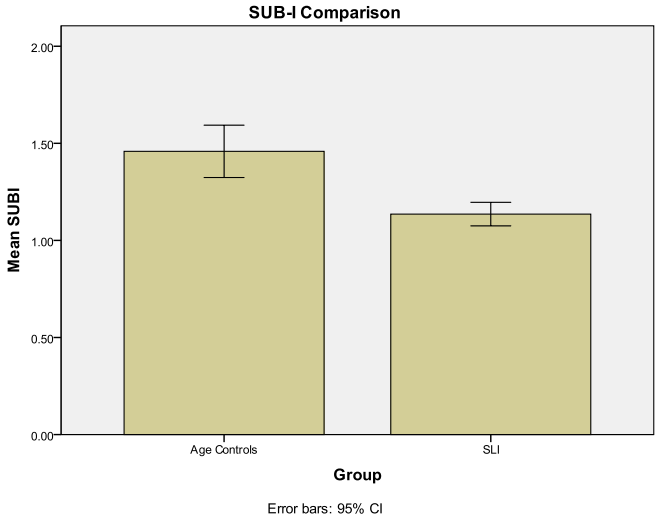

Figure 24

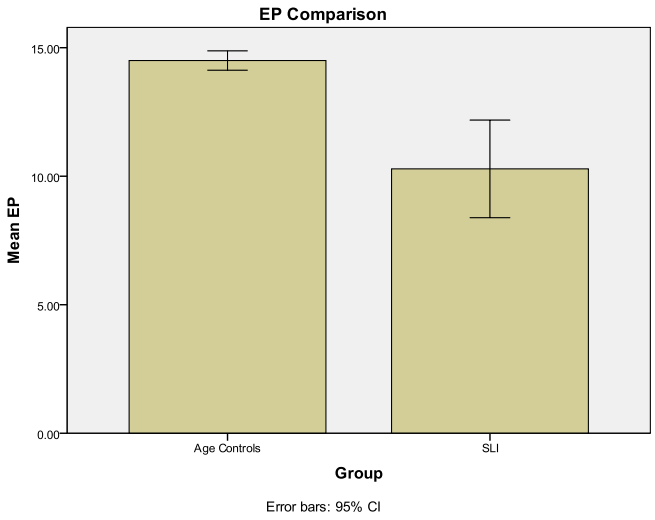

Figure 25

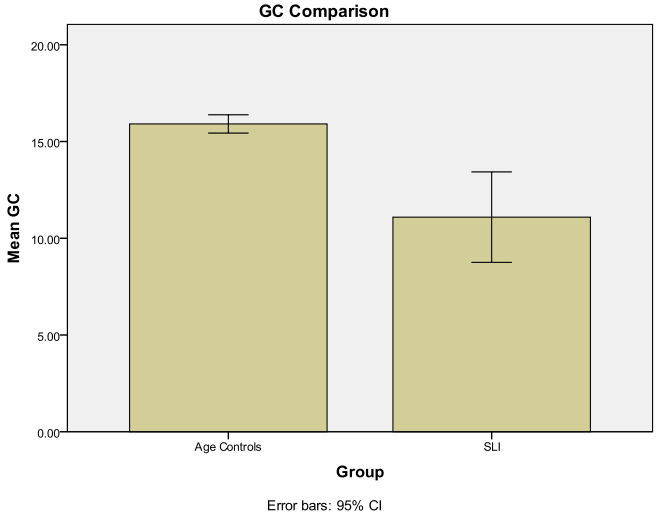

Figure 26

Group Statistics With Partial eta^2

	Group	eta^2	Mean	Std. Deviation
MLTU	Age Controls	*.427	5.3921	.99715
	SLI		3.7938	.89192
Errors/TU	Age Controls	.001	.1513	.11517
	SLI		.1450	.10803
MLUw	Age Controls	*.490	5.4014	1.70005
	SLI		2.8853	.73847
MLUm	Age Controls	*.437	6.9121	2.50415
	SLI		3.6247	1.00203
MLUvp	Age Controls	*.406	4.8329	1.70709
	SLI		2.7196	.70053
NDW	Age Controls	*.356	192.1667	55.71095
	SLI		128.5833	26.59342
TTR	Age Controls	*.263	.3713	.05860
	SLI		.4471	.07040
SUB-I	Age Controls	*.308	1.4588	.31938
	SLI		1.1354	.14392

Table 4.0 – The comparison of the two populations in terms of each spontaneous measure

The table above summarizes all of the measures and shows that 7 of the spontaneous measures are statistically significant in differentiating between typically developing children and children with SLI. These seven measures correlate with the Grammaticality Choice Task and elicited production test as well. The two measures that most effectively distinguish the two populations and will be most useful, are MLUw and MLUm. MLUw and MLUm were also the measures that most highly correlated with the EP test. Eta-squared is a calculation in the t-test family that is analogous to r^2 in correlation and regression. This number is therefore interpreted in a similar way. The eta-squared value expresses the size of the effect of difference between the two populations.

Chapter 5: Study 3 – Discriminant Function Analysis

Section 5.0: Discriminant Function Analysis (DFA)

As illustrated in the previous section, a control group and an SLI group, which varied in size, according to the particular test, were shown to be significantly different from one another, with the control group scoring higher, for each of the dimensions considered, with the exception of Errors per T-unit. Given these differences, we now turn to the question of the degree of sensitivity and specificity that each of these measures yields in distinguishing children with SLI from neurotypical children.

Predictive discriminant analysis was used to determine how well these measures discriminated between the children with SLI and their typically developing peers (Klecka, 1980). All of the variables were subjected to discriminant analysis and cross validation (SPSS, 2010). Discriminant analysis generates a discriminant criterion that maximizes the distance between the groups. Cross validation uses the discriminant criterion to assess the error rate for the discriminant function by comparing each observation to the remaining data set and calculating the probability that it belongs to either of the groups (Bedore & Leonard, 1998). The percentage and actual number of cases that were correctly classified in the cross-validation analysis are summarized below. Discriminant accuracy of 80% or greater is considered fair, and accuracy above 90% is considered good (Plante & Vance, 1994).

The following table illustrates the discriminant functions derived from our IGDs and their tested combinations that yielded at least fair (80%) sensitivity or specificity. The two that most closely approximated good (90%) both sensitivity and specificity were elicited production with SUB-I and grammaticality choice with MLUw. When looking at

all ten measures at the same time, the sensitivity and specificity are both good. Our sample is 55 children, but not all 55 children took both the elicited production test and the Grammaticality Choice task. Therefore the n is a little skewed because this only includes 29 of the 55 children.

Measure(s)	Sensitivity % (# correctly identified)	Specificity % (# correctly identified)	N
EP	66.78 (12/18)	100 (18/18)	36
GC MLUw	90.48 (19/21)	72.00 (18/25)	46
All measures	85.71 (12/14)	87.50 (14/16)	29
EP NDW	83.33 (15/18)	94.44 (17/18)	36
EP MLTU	83.33 (15/18)	94.44 (17/18)	36
EP SUB-I	88.89 (16/18)	94.44 (17/18)	36

Table 5.0 – The most parsimonious combinations of all ten measures analyzed in this study

Chapter 6: Discussion and Conclusion

There is a high degree of correlation between the IGDs and both EP and GC tests. Following Castilla, we find the use of both receptive and productive modalities (spontaneous speech production and other tasks) is useful in discriminating among TD and SLI groups. Our study supports Castilla's findings which keeps this debate both current and relevant. In the future, a logistic regression may be used to further tease out the variation corresponding to each measure.

Some of the IGDs are good at distinguishing SLI from typically developing. In Owen and Leonard (2002) and Watkins, Kelly, Harbers, & Hollis (1995), TTR was not effective for distinguishing children with language impairment from neurotypical children. However, in this study TTR was a good distinguisher. This is interesting because it is not immediately clear why this should be so in Spanish, but not in English. How could the lexicons of the two languages be different such that the Spanish lexicon

would be sensitive to this measure for children with SLI, but not so for English? We leave this intriguing question for future research.

The DFA suggests that measures of tense are fair to good predictors in Spanish, particularly when supplemented with IGDs. The best combination is EP and SUB-I as sensitivity is good and specificity is fair, verging on good. Also, both of these measures independently are good at distinguishing between typically developing children and children with SLI. Although this study was done with a relatively small sample, it is of great interest to see whether these results are replicable with a larger sample size in a future study. Also a further test with a greater sample size is called for to make clearer distinctions.

Errors/TU seems to not be a coherent measure. Errors/TU does not correlate with either the receptive test nor the productive test. It is usually used in conjunction with MLTU, but in this case it looked completely independent of lexicon, grammar, and SLI.

Concluding, early intervention for children at risk of developing dyslexia is very important, as is eventually contributing to help distinguish typically-developing bilingual children from those with SLI. In this project, I hope to have contributed to this effort by, if nothing else, laying the groundwork for future research that seeks to understand the differences between developmental lexical and syntactic measures, the difference between English and Spanish-speaking children with SLI and to a greater understanding of the SLI deficit itself.

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Chapter 8: List of Tables

Chapter 9: Appendices

Instructions MLUvp

-include repetitions
-count “ah ha” as 1 word
-Do not count mm, mhm, oh, um, uh, eh, ay, este (when used as a filler)

Ex. CHI: mmm

Word count: 0

‘Fillers’ like this are not counted. Since this is still an utterance, you need to add the 0 in the total average when calculating MLUvp.

-If there is a stated subject before or after the verb, omit the subject from the count

Ex. CHI: El otro tigre no quiere ayudar

Subject: el otro tigre

Verb: quiere

Word count: 3 (because subject is omitted)

Ex. INV: ¿Qué película te gusta?

CHI: los increíbles

Word count: 2

Even though the child answered with a subject, it was not followed by a verb, so the subject gets counted.

-skip unintelligible speech

Instructions for MLUm

-Follow Brown’s rules
-Suppletive forms treat as 1 morpheme

Ex. no sé 2 morphemes

-Do not include fillers
-Include repetitions
-Count full utterances, not stutters

Ex. CHI: u u u una, just count ‘una’ which is 2 morphemes

-Nouns - count morphemes for singular and plural

Ex. rojas – roja s 2 morphemes

Ex. hijo and hija are both considered 1 morpheme

-Adjectives - count morphemes for gender and number

Ex. rojas – roj a s 3 morphemes

-All infinitives are 3 morphemes (including ser)
-Verbs count stem, theme vowel (if present), and inflectional morpheme

Ex. hicieron – hic ie ron 3 morphemes; cantaron – cant a ron 3 morphemes

-Stem changes do not matter in terms of morpheme count

Ex. tienes – tien e s 3 morphemes

- When ‘los’ is definite article, count as 1 morpheme, but if ‘los’ is in a clitic form, count as 2 morphemes
-Compound words count as 1 morpheme
Ex. conmigo
-Count proper names as separate morphemes
Ex. Ana Maria 2 morphemes
-‘a ver’ and ‘mira’ are single lexical items, count as 1 morpheme
-Count diminutives as separate morphemes
Ex. pecesitos – peces ito s 3 morphemes
-al and del are 2 morphemes since they are contractions of 2 words
-If foreign word, count as one morpheme
Ex. cars – there is a movie called Cars, but do not count as 2 morphemes (car and s – for plural marker), but just as 1 morpheme

Instructions for Mean Length of Utterance in Terminable Units (MLTU), Errors per T-unit

-T-unit Definition: A t-unit contains one independent clause and any dependent clauses or nonclausal structures that are attached to it or embedded within it.
Ex. Bill bought a new bicycle before he went to Europe. – 1 T-unit that includes an independent clause (Bill bought a new bicycle) and a dependent clause (before he went to Europe).
Ex. Bill went to France and then he went to Italy. – 2 T-units because there are 2 independent clauses joined by the coordinating conjunction “and.”
-Whenever a coordinating conjunction (and, but, so) initiates an independent clause, that clause is considered to be a new T-unit.
-Conjoined subjectless sentences count as separate T-units.
-Do not count false starts or repetitions.
-Do not count incomplete words.
Ex. CHI: no te rasques porque a lo **mej** te sale una bolita si te rascas.
-Fragments are not considered T-units, it must be a sentence with a verb and explicit or implicit (because of Pro-drop) subject. The full utterance is not considered if any part of the utterance has unintelligible speech. Ex. No XXX…
-In order to calculate MLTU – count the number of words per T-unit.
-In order to calculate Errors per T-unit – count the number of errors per T-unit

Instructions for Subordination Index (SUB-I)

-SUB-I is a measure of syntactic complexity which produces a ration of the total number of clauses to the total number of T-units.
-Utterances that are incomplete or unintelligible are excluded from the SUB-I analysis.

-When an elliptical response to a question is not a clause, it is not included. Elliptical responses are answers to questions that lack only the "repetition of the question elements to satisfy the criterion of independent predication."

Ex. [Se subió a la piedra] [y cayó de la piedra] – 2 separate clauses so 2 SUB-I's

Ex. [Luego corrió] [y miro] – 2 clauses = 2 SUB-I

-If a subordinating conjunction is not obligatory to the coherence of the utterance, the subordinate clause should still receive a score for SI.

Ex. I know I want to go = 2 SUB-I ("that" can be implied in the utterance)

-Do not count infinitives as clauses.

Ex. The boy told the dog <u>to be quiet</u>. = 1 SUB-I